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Docket Number 50-346

License Number NPF-3

Serial Number 3065

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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Request for Additional Information Regarding Root Cause Analysis Report
(TAC No. MC1642)

Ladies and Gentlemen:

Background

By letter dated February 11, 2003, the Nuclear Regulatory Commission (NRC) issued Order EA-03-009, establishing inspection requirements for Reactor Pressure Vessel (RPV) heads at pressurized water reactors (FirstEnergy Nuclear Operating Company (FENOC) Letter Log Number 6055). By letter dated February 20, 2004, the NRC issued a revised Order (FENOC Letter Log Number 6161, henceforth, the "revised Order") superceding the requirements established in the original Order.

By letter dated March 4, 2004 (FENOC Letter Log Number 6167), the NRC staff issued a request for additional information concerning the Davis-Besse Nuclear Power Station Unit Number 1 (DBNPS) technical Root Cause Analysis Report, "Significant Degradation of the Reactor Pressure Vessel Head". This report was first submitted to the NRC by the FirstEnergy Nuclear Operating Company (FENOC) under letter Serial Number 1-1270, dated April 18, 2002, and Revision 1 of the report was later submitted under Serial Number 1-1289, dated September 23, 2002.

Question 2 of the NRC's March 4, 2002 letter requested information about the Reactor Coolant System hot leg temperature that FENOC would use to calculate Effective Degradation Years (EDY) of the already installed new RPV head. FENOC responded by letter Serial Number 3045 on May 25, 2004, that in consideration of the requirement of the revised Order to use a "best estimate" temperature, FENOC planned to use an average of the hot leg narrow range temperature readings from the hottest Reactor Coolant System loop.

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On June 18, July 14, and July 21, 2004, conference calls were held between FENOC and members of the NRC staff, to discuss in greater detail the basis for FENOC's proposed method. The following summarizes the information provided by FENOC during these conference calls.

Evaluation of Hot Leg Temperatures

AREVA (Framatome ANP) Document 32-5011757-01 calculated the hot leg temperature for normal 100% power operation as 606.1°F. A review of a daily sampling of narrow range hot leg temperature readings from the last operating cycle (Cycle 13) plant computer files shows that at 100% power, the cycle average temperatures from the loop with the highest hot leg temperature were comparable with this calculated hot leg temperature. During the cycle, there were several periods in which the plant was operated at reduced power levels and/or reduced reactor coolant temperatures. These periods reduced the cycle average hot leg temperature to slightly less than the calculated value for normal 100% power operation. The following table summarizes the results of this review and comparison with the calculated hot leg temperature:

	RCS TEMPERATURE	**REACTOR POWER**	**TEMPERATURE**
Cycle 13	Normal Operation	>99%	606.4*
Cycle 13	Normal Operation	All Power Levels	605.8*
Cycle 13	Normal Operation & Reduced Temperature at End of Cycle	All Power Levels	605.5*
Calculated	Normal	100%	606.1
* Temperature is an average of the valid narrow range hot leg readings for the loop with the highest average hot leg temperature.			

Every cycle has periods of reduced temperature operation. For example, these periods result from testing, maintenance, power escalation from shutdown, System Control Center dispatcher requests to reduce power, and plant coastdown at the end of core life. These periods of reduced temperature operation result in reduced RPV degradation that is not credited by the proposed EDY calculation methods, thereby adding conservatism.

In this case, using the average of the readings from the narrow range instruments on the hot leg with the highest temperature would have resulted in a conservative slight increase in the EDY calculation input temperature from 606.1°F (calculated) to 606.4°F (observed). Forward-looking calculations may require future adjustment to correct for changes in plant operating temperature (such as caused by changes in licensed power), changes in steam generator efficiency (such as caused by steam generator tube plugging), or changes in the length of operating cycles. However, the potential impact of a

temperature increase on the inspection schedule required by revised Order EA-03-009, based on a 23-month cycle, is such that a postulated hot leg temperature increase to 608.3°F is estimated to be required to accelerate the beginning of the Primary Water Stress Corrosion Cracking (PWSCC) moderate susceptibility classification from refueling outage 17 RFO (approximately 92 operating months) to 16 RFO (approximately 69 operating months); the next refueling outage being 14 RFO. It should be noted, however, that inspections equivalent to those required under the PWSCC moderate susceptibility classification are already planned to be performed for the already installed new RPV head, beginning with the performance of a bare metal examination of 100 percent of the RPV head surface (refer to paragraph IV.C.(2)) during 15 RFO, to avoid having the time-based requirements of the replaced susceptibility classification expire during the sixteenth operating cycle. This is due to the revised Order using a five-year frequency as follows:

> (4) An inspection meeting the requirements of paragraph IV.C.(5)(a) must be completed at least every third refueling outage or every 5 years, whichever occurs first. The requirements of IV.C.(5)(b) must be completed at least every 4 refueling outages or every 7 years, whichever occurs first.[1]

In addition, by letter dated March 11, 2004 (letter Serial Number 3033), FENOC committed to conducting a bare metal visual examination of 100 percent of the RPV head surface (including 360 degrees around each RPV head penetration nozzle) every refueling outage. These inspections will meet the requirements of the inspections discussed in paragraph C.(5)(a) of revised Order EA-03-009, and will be performed at a greater frequency than required by the revised Order.

Therefore, small changes in the temperature used to calculate the beginning of the PWSCC moderate susceptibility classification will have no significant impact on plant operation or the related DBNPS RPV inspection frequencies.

The corresponding impact point for commencing the high susceptibility inspections is estimated at a hot leg temperature of 611.3°F for the DBNPS. This point is at a high enough temperature so that the inspection schedule will not be affected by small changes in the inputs to the EDY calculation.

Based on the expected future operation of the DBNPS and the requirements of revised Order EA-03-009, it is predicted that FENOC will perform the PWSCC high susceptibility inspection activities at the DBNPS every refueling outage after the eighteenth operating cycle, until such time as the RPV upper head is again replaced.

The following table shows the type and frequency of inspections through the nineteenth refueling outage based on the calculated EDY at 606.4°F (Cycle 13 average of the valid narrow range hot leg readings for the loop with the highest average temperature), 608.2°F (temperature just below that which is estimated to cause an earlier change from the low to the moderate susceptibility category), and 611.2°F (temperature just below that which is

[1] Revised Order EA-03-009 at 9.

estimated to cause an earlier change from the moderate to the high susceptibility category). Of note, although the reason for the type of inspection changes, due to the operating cycle length, revised Order inspection requirements, and DBNPS-specific requirements, the scope of inspections are expected to be the same at all three temperatures.

EXPECTED INSPECTION SCOPE VS. TEMPERATURE
(Estimate based on 23 month operating cycle at 100% power)

			EDY @ Temperature			@606.4 F			@608.2 F			@611.2 F		
RFO	Year (est)	Time (Yr)	606.4	608.2	611.2	5(a)	5(b)	R	5(a)	5(b)	R	5(a)	5(b)	R
14	2006	1.92	2.48	2.66	3.00	X		C	X		C	X		C
15	2008	3.83	4.96	5.32	6.00	X		C/5	X		C/5	X		C/5
16	2010	5.75	7.43	7.99	8.99	X	X	C,7	X	X	C,7	X	X	C,M
17	2012	7.67	9.91	10.65	11.99	X		C,M	X		C,M	X		C,M
18	2014	9.58	12.39	13.31	14.99	X	X	C,H	X	X	C,H	X	X	C,H
19	2016	11.50	14.87	15.97	17.99	X	X	C,H	X	X	C,H	X	X	C,H

RFO Refueling outage number

5(a) Bare metal visual examination of 100 percent of the RPV surface, including 360° around each RPV head penetration nozzle

5(b) Non-visual Non-Destructive Examination (NDE)

R Reason

X Inspection Required

C Commitment (In letter Serial No. 2804)

5 Inspect before five years (Low Susceptibility activity)

7 Inspect before seven years (Low Susceptibility activity)

C/5 Visual inspection required by commitment and by five year Low Susceptibility activity

C,7 Commitment for visual inspection; seven year (Low Susceptibility) non-visual NDE

C,M Commitment for visual inspection; Moderate Susceptibility (8 EDY) non-visual NDE

M Visual inspection required by commitment and by Moderate Susceptibility (8 EDY)

H High Susceptibility (12 EDY)

In summary, using the average temperature as read by the narrow range instrumentation on the hot leg with the highest temperature is estimated to provide a value comparable to the calculated hot leg temperature. [The highest individual reading will not produce the "best estimate," since it will preferentially select a reading that is likely to have been affected by instrument failure or drift.] The result is expected to be conservative with respect to the actual value since reduced power and temperature values are not included. Accordingly, FENOC believes this method is appropriate to use to determine a best estimate "100% power head temperature" for calculating the EDY for the DBNPS RPV head under revised Order EA-03-009. For Cycle 13, this method would have produced an estimated 100% power head temperature of 606.4°F.

Additional Information Regarding "Best Estimate" Temperature

Revised Order EA-03-009 provided the following instruction for the EDY calculation: "This calculation shall be performed with best estimate values for each parameter..." The EDY formula contains the following parameter, subject to estimation:

$T_{head,j}$ = 100% power head temperature during time period j (°R=°F + 459.67)

Industry practice appears to estimate 100% power head temperature using nominal design hot leg temperatures, based on the theory that the high mass flow rate in the Reactor Coolant System would only allow minimal heat transfer from the reactor coolant as it passes from the reactor vessel to the hot legs.

By letter on March 4, 2004, the NRC staff asked the following question:

> Inform the staff as to which temperature value you will use in determining the EDY of your new RPV head, i.e., the average of hot leg temperatures or the highest hot leg temperature. If you do not plan to use the highest hot leg temperature, then respond to items B and C below.

As FENOC previously noted in letter Serial Number 3045, dated May 25, 2004, FENOC also considered using temperature data from the reactor vessel continuous vent line. However, FENOC has determined that this instrumentation is significantly less accurate when compared to the accuracy of the narrow range hot leg temperature instrumentation, has not been calibrated at temperatures over 200°F, and is not safety grade. Furthermore, using vent line data would be inconsistent with industry practice for plants such as the DBNPS, and would produce data that would be difficult to correlate to PWSCC susceptibility factors based on hot leg temperature data.

FENOC believes that the best estimate data required by the revised Order EA-03-009 comes from the same parameter (i.e., hot leg temperature) used to develop the EDY formula. Therefore, FENOC plans to use hot leg temperature to calculate EDY.

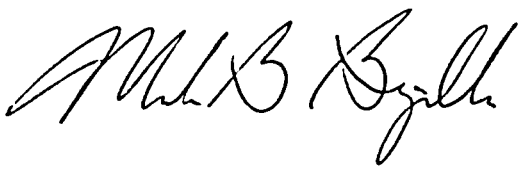
However, FENOC proposes to use the actual hot leg temperature history from the plant computer (using the average of the narrow range readings from the hot leg with the highest temperature) instead of a nominal 605°F temperature.

Conclusion

Based on the discussion above, FENOC plans to use the average temperature, as read by the narrow range instrumentation on the hot leg with the highest temperature during full power operation, to calculate the EDY for the DBNPS RPV head under revised Order EA-03-009. FENOC believes this value is appropriate, based on the EDY formula contained in revised Order EA-03-009.

If you have any questions or require further information, please contact Mr. Gregory A. Dunn, Manager – Regulatory Affairs, at (419) 321-8450.

Very truly yours,



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Attachment A: Commitment List

cc: J. L. Caldwell, Regional Administrator, NRC Region III
J. B. Hopkins, DB-1 Senior NRC/NRR Project Manager
C. S. Thomas, DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

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Attachment A

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station, Unit Number 1, (DBNPS) in this document. Any other actions discussed in the submittal represent intended or planned actions by the DBNPS. They are described only for information and are not regulatory commitments. Please notify the Manager – Regulatory Affairs (419-321-8450) at the DBNPS of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
None	NA